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REMARKS/ARGUMENTS

Reconsideration of the present application, as amended, is respectfully requested.

A. STATUS OF THE CLAIMS

As a result of the present amendment, claims 1-4 and 6-23 are presented in the case for continued prosecution. Claim 1 has been amended to incorporate the limitations of claim 5 and to incorporate the previously optional sintering step of claim 2. Claim 5 has been cancelled.

New dependent claims 21-23 have been added to address the 35 U.S.C. § 112 rejections explained further below.

B. THE INVENTION

The present invention, as defined by the amended claims, includes a method for fabricating a functional dental element in a flexible and efficient manner using a three-dimensional printing technique. Layers of a suitable material are successively applied onto each other, each layer being bonded at desired positions to a preceding layer. Thereafter, the particles are bonded together by sintering, and the sintered element is subjected to infiltration whereby a second phase is introduced to reduce the porosity of the product.

One of the advantages of the claimed invention is that dental elements can be tailor-made taking into account required shape, dimension and color pattern. In addition, the dental elements of the present invention display unique properties in terms of mechanical performance and color stability.

C. OBJECTIONS TO THE SPECIFICATION

The Examiner has stated that the Application does not contain an Abstract and appropriate section headings. Applicant notes that the Application does indeed contain an Abstract (see cover sheet of PCT Application). Nevertheless, Applicant has provided a replacement Abstract identical to the Abstract as deemed previously submitted.

With regard to the objections to the specification, Applicant has amended various portions of the specification to insert the appropriate section headings.

D. REJECTIONS UNDER 37 C.F.R. 1.75(c)

Claim 18 has been objected to as being in improper form for being a multiple dependent claim that depends upon another multiple dependent claim. Applicant, however, notes that claim 18 is not in multiple dependent form, nor is claim 17 or claim 1 upon which claim 18 ultimately depends. The Preliminary Amendment of February 22, 2002 removed multiple dependency throughout the claims. Thus, Applicant disagrees with this rejection. Nevertheless, Applicant has amended claim 18 to be dependent upon claim 1.

E. USE OF TRADEMARKS

The Examiner had objected to the use of trademarks on page 7, lines 17-18 for failure to capitalize the entire trademark. Applicant has amended capitalized each letter of the trademarks and placed the appropriate “®” after each trademark to illustrate the propriety nature. There are no claims containing trademarks.

F. REJECTIONS UNDER 35 U.S.C. § 112, second paragraph

Claims 1-17, 19 and 20 have been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite.

In claim 1, the use of the technique in the term “wherein a three-dimensional printing technique is used” had been determined to be unclear. Applicant has amended claim 1 to further define the procedure of the three-dimensional printing technique by incorporating the limitations of claim 5. Claim 5 has thus been cancelled.

Claims 2 and 3 have been rejected for reciting the broad recitation “optical scan technique” as well as the narrow recitation “preferably a laser scan technique”. Claims 2 and 3 have also been rejected for being identical. Applicant has amended claim 3 to delete reference to the laser technique. New claim 21 has been added to recite that the optical scan technique is a laser technique. This amendment has not been made to claim

2, because claims 2 and 3 are not identical because claim 2 is directed to further defining the sintering step whereas claim 3 defines how the dental element is measured.

Claims 6-8 have been rejected because the term "the binder" lacks basis. However, claim 6 recites "a binder", and claims 7 and 8 recite "the binder" and are dependent upon claim 6. Thus, there is proper basis for this term.

Claim 8 has been rejected for failing to use the word "consisting" in the Markush language. Applicant has amended claim 8 to include this word.

Claim 9 has been objected to because the term "the powder" lacks basis. Claim 9, however, is dependent upon claim 6, and claim 6 recites "a powder". Basis therefore exists.

Claim 9 has also been rejected for reciting the broad recitation "ceramic materials" as well as the narrow recitation "such as...", in addition to reciting the broad recitation "metals" as well as the narrow recitation "such as alloys of...". Applicant has amended claim 9 to delete reference to the specific types of ceramic materials and the specific types of metals. The specific types of ceramic materials and the specific types of metals have been presented in new claims 22 and 23.

Claim 11 has been rejected because the term "the powder" lacks basis. Basis does in fact exist, since claim 6 recites "a powder" and claim 11 is dependent upon claim 6.

Claim 12 has been rejected for reciting that powders of a different nature "are used". Applicant has amended claim 12 to more clearly recite that the powder comprises powders of a different nature. A similar amendment has been made to claim 13.

Finally, claim 19 has been rejected for reciting that the dental element is "additionally shaped", but no previous shaping step is recited. Applicant has deleted the word "additionally" as correction.

It is urged that the claims are in proper form and that the present amendment addresses each rejection under 35 U.S.C. § 112, second paragraph. Reconsideration and removal of the rejection is therefore proper and respectfully requested.

G. REJECTIONS UNDER 35 U.S.C. § 112, first paragraph

Claims 1-17, 19 and 20 have been rejected under 35 U.S.C. § 112, first paragraph, for lack of enablement. Applicant presumes that this rejection was made in light of the

indefiniteness rejection to claim 1 under 35 U.S.C. § 112, second paragraph. As amended, claim 1 provides objective enablement of the claimed subject matter. Nothing more is required by the statute. Thus, Applicant submits that this rejection is overcome by the amendment to claim 1 clarifying the method of the present invention.

II. REJECTIONS UNDER 35 U.S.C. § 102(a)

The Examiner has rejected the subject matter of claims 1, 4, 5 and 20 under 35 U.S.C. § 102(a) as being anticipated by US Patent No. 5,902,441 to Bredt. The Examiner has also rejected the subject matter of claims 1-6, 9, 11 and 20 under 35 U.S.C. § 102(a) as being anticipated by US Patent No. 6,322,728 to Brodkin. In order to maintain an anticipation rejection under 35 U.S.C. § 102, a prior art reference must disclose each and every element of the rejected claims with sufficient clarity to prove its existence in the prior art. Furthermore, under 102(a), a patent is barred if the invention was "patented or described in a printed publication in this or a foreign country" prior to the applicant's date of invention. Description by a prior publication occurs where the work adequately describes the invention in question and the work qualifies as a "printed publication." The description must enable a person with ordinary skill in the art not only to comprehend the invention but also to make it.

Turning first to Bredt, Bredt teaches a three-dimensional printing technique. The Examiner has pointed to column 1, line 46 of Bredt where it is explained that the three-dimensional printing technique is useful in the field of dentistry.

Bredt describes uses of the three-dimensional printing technique in very general terms only. Bredt explains that three-dimensional printing has been used to make ceramic molds and castings to ultimately generate fully-functional metal parts (col. 1, lines 37-39). Bredt further mentions additional uses of the three-dimensional printing technique, but characterizes these further uses as "contemplated" uses (col. 1, lines 39-40). One of these further "contemplated" uses is in the field of dentistry (col. 1, lines 41-46).

It logically follows that Bredt suggests that the "contemplated" uses in the field of dentistry would include using the three-dimensional printing technique to form ceramic molds and castings that would ultimately be used to generate fully-functional metal parts.

The molds and castings formed by the three-dimensional printing technique as suggested by Bredt, however, are not final and long lasting products like the dental elements of the present invention. The molds and castings are only models used to assist in the fabrication of the actual, final product.

Thus, Bredt suggests, at best, the use of the three-dimensional printing technique to form an intermediate, mold or casting. One skilled in the field of medicine would understand that the intermediate molds or castings suggested by Bredt would be used to form artificial body parts such as bones or joints. In comparison to the field of dentistry, one of skill would make the correlation that Bredt suggests the use of intermediate molds or castings to form artificial body members such as artificial jawbones. The dental elements of the present invention, however, are not artificial body members and are not even part of the human skeleton. The dental elements of the present invention are located outside the human body, are easy to replace, and are constructed of different materials compared to the artificial body members suggested by Bredt.

Applicant therefore submits that Bredt at most suggests the use of the three-dimensional printing technique for the fabrication of intermediate molds or models used to ultimately form artificial body members that are integral parts of the human skeleton. Clearly, Bredt does not teach or suggest use of the three-dimensional printing technique for the fabrication of an ultimate final product such as an external dental element.

Furthermore, Bredt does not teach the sintering step and the infiltration step of the present invention.

Bredt teaches that wax infiltration can be employed as a post-processing step (col. 4, lines 10-11). Wax infiltration, however, is completely unsuitable for the fabrication of dental elements. This is further supported by the fact that Bredt is concerned with the fabrication of appearance models and functional parts in an Office environment, not with dental elements (col. 3, lines 30-34). In contrast to the wax infiltration of Bredt, claim 1 recites that infiltration is performed using a second phase that reduces porosity of the final product (see page 8, lines 28-30 of the Application). Bredt therefore does not teach or suggest the second phase infiltration of claim 1.

In addition, the infiltration terminology used by Bredt is in reference to the binder infiltrating the gaps in the powdered material to bind the powdered particles together (col.

2, lines 24-26). In contrast, the infiltration step of claim 1 is performed after the sintered dental element is formed, not before formation. Thus, the infiltration step of claim 1 is clearly not disclosed by Bredt.

Finally, Bredt makes no mention of a sintering step used to obtain dental elements having long lasting and sufficient mechanical properties. The sintering step of the present invention is recited in claim 1.

Turning now to Brodkin, Brodkin has been cited to teach the production of articles by three-dimensional printing. The Examiner has also stated in the rejections under 35 U.S.C. § 103 (a) that Brodkin teaches sintering the obtained element. The Examiner, however, did not cite a portion of Brodkin to support the referred to sintering step.

Brodkin teaches the use of multiple solid free-form (SFF) fabrication techniques of dental restorations. Brodkin teaches that dimensional printing and fused deposition modeling are the preferred SFF techniques (col. 2, lines 30-39). Example 1 of Brodkin employs the fused deposition modeling method (a microextrusion technique), while Example 2 of Brodkin employs a three-dimensional printing method.

The fused deposition method is not a three-dimensional printing technique which is required by claim 1. Furthermore, the fused deposition modeling technique of Example 1 of Brodkin provides an inadequate dental element having a tolerance of about 200 μm , while adequate dental elements require a tolerance of 30-50 μm . Applicant therefore submits that the method of claim 1 is not taught or suggested by Example 1 of Brodkin.

With regard to Example 2 of Brodkin, the three-dimensional printing technique is employed whereby subsequent glass infiltration is performed. However, Example 2 of Brodkin performs no sintering step. Thus, Example 2 of Brodkin does not teach or suggest the specific method of claim 1.

Applicant submits that the method of claim 1 is not taught or suggested by Bredt or Brodkin. Reconsideration and removal of the rejections is therefore proper and requested.

L. REJECTIONS UNDER 35 U.S.C. § 103(a)

The Examiner has rejected the subject matter of claims 1-6, 9-15, 17, 19 and 20 under 35 U.S.C. § 103(a) as being unpatentable over US Patent No. 6,322,728 to Brodkin in view of US Patent No. 5,204,055 to Sachs. The Examiner has also rejected the subject matter of claims 7 and 8 under 35 U.S.C. § 103(a) as being unpatentable over US Patent No. 6,322,728 to Brodkin in view of US Patent No. 5,204,055 to Sachs and in further view of US Patent No. 5,641,434 to Yamada. Finally, the Examiner has rejected the subject matter of claim 16 under 35 U.S.C. § 103(a) as being unpatentable over US Patent No. 6,322,728 to Brodkin in view of US Patent No. 5,204,055 to Sachs and in further view of US Patent No. 4,705,762 to Ota.

A *prima facie* case of obviousness is established only when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art. The art must suggest how to apply its teachings to the specifically claimed invention.

Sachs has been cited to teach applying a powder layer with a doctor blade and utilizing layers of different compositions. Yamada has been cited to teach polyvinyl alcohol and acrylate binders for ceramic powders. Ota has been cited to teach the particle size of the present invention. None of the references, however, cures the deficiencies of Brodkin et al. discussed above.

Sachs, Yamada and Ota do not teach or suggest the method of the present invention as recited in claim 1. Thus, Applicant submits that the present invention is patentable over all of the cited references taken alone or in combination. Reconsideration and removal of the rejections is therefore proper and requested.

J. FEES

This response is being filed within the shortened period for response. No further fee is believed to be due. If, on the other hand, it is determined that any further fees are due or any overpayment has been made, the Commissioner is hereby authorized to debit or credit such sum to Deposit Account No. 02-2275. Pursuant to 37 C.F.R. 1.136(a)(3), please treat this and any concurrent or future reply in this application that requires a petition for an extension of time for its timely submission as incorporating a petition for

extension of time for the appropriate length of time. The fee associated therewith is to be charged to Deposit Account No. 02-2275.

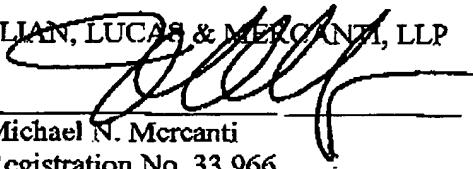
K. CONCLUSION

In view of the actions taken and arguments presented, it is respectfully submitted that each and every one of the matters raised by the Examiner have been addressed by the present amendment and that the present application is now in condition for allowance.

An early and favorable action on the merits is earnestly solicited.

Respectfully submitted,

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